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10/657,729	09/08/2003	Joseph Franklin Ethridge	MMO-001.01	8912

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EXAMINER	
JACOB, MARY C	
ART UNIT	**PAPER NUMBER**
2123	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/657,729	Applicant(s) ETHRIDGE ET AL.	
	Examiner Mary C. Jacob	Art Unit 2123	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on _08 September 2003_.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _1-6_ is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) _1-6_ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on _08 September 2003_ is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _7/26/04_.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

1. Claims 1-6 have been presented for examination.

Drawings

2. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference character(s) not mentioned in the description: Figure 1 is not mentioned in the description.

3. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include the following reference sign(s) mentioned in the description: 10.

4. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(4) because reference character "50" has been used to designate both Figure 3, element 50 and Figure 4, element 50.

5. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of

any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Objections

6. Claims 1-3 are objected to because of the following informalities. Appropriate correction is required.

7. Claim 1 recites the limitation "the shape" in line 3, it would be better if written “a shape”.

8. Claim 2, “the stored quadratures” in line 2 would be better if written “the stored canonical quadratures”.

9. Claim 2 recites “a canonical integration interval” in lines 4-5 and then “the canonical interval” lines 6, 8, 15, 16 and 17. It would be better if written “the canonical integration interval” in lines 6, 8, 15, 16 and 17.

10. Claim 3 recites “one or more points” in line 7, it would be better if written “one or more target points”.

Claim Rejections - 35 USC § 112

11. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

12. Claims 1-6 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

13. The term "a given angle range" in claim 1, line 13 is a relative term which renders the claim indefinite. The term "a given angle range" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention.

14. Claim 1 recites the following limitation “at least in part” in line 15. This limitation renders the claim vague and indefinite because it is not understood what else is needed to determine the field dependent characteristic.

15. Claim 2 recites “the integration, over the canonical integration interval” in lines 4-5. It is unclear if this “integration” is a new integration operation, or if it is referring to the “numerical integration over the boundary of an integrand defined thereon” recited in claim 1, lines 6-7.

16. Claim 2 recites the limitation "the product" in line 5. There is insufficient antecedent basis for this limitation in the claim.

17. Claim 2 recites the limitation “the value” in line 9. There is insufficient antecedent basis for this limitation in the claim.

18. Claim 2 recites the limitation "the relative target node position" in lines 9-10. There is insufficient antecedent basis for this limitation in the claim.

19. Claim 2 recites the limitation "the relative target node position" in lines 9-10, however, it is unclear as to whether this “the relative target node position” corresponds to “a respective position of a target node” recited in lines 2-3.

20. Claim 2 recites "a problem interval" in lines 14-15. It is unclear as to whether this "problem interval" corresponds to the same "problem interval" as in claim 1, lines 5 and 11.

21. Claim 3 recites the limitation "the canonical-quadrature-integration operation" in line 8. There is insufficient antecedent basis for this limitation in the claim.

22. Claim 3 recites the limitation "the second contribution" in line 10. There is insufficient antecedent basis for this limitation in the claim.

23. Claim 4 recites the limitation "the number of angle ranges" in line 1. There is insufficient antecedent basis for this limitation in the claim.

24. The term "a single angle range" in claim 6 is a relative term which renders the claim indefinite. The term "a single angle range" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention.

Claim Interpretation

25. Office personnel are to give claims their **"broadest reasonable interpretation"** in light of the supporting disclosure. *In re Morris,* 127 F.3d 1048, 1054-55, 44 USPQ2d 1023, 1027-28 (Fed. Cir. 1997). Limitations appearing in the specification but not recited in the claim are not read into the claim. *In re Prater,* 415 F.2d 1393, 1404-05, 162 USPQ 541, 550-551(CCPA 1969). See *also *In re Zletz,* 893 F.2d 319, 321-22, 13 USPQ2d 1320, 1322(Fed. Cir. 1989) ("During patent examination the pending claims

must be interpreted as broadly as their terms reasonably allow") .... The reason is simply that during patent prosecution when claims can be amended, ambiguities should be recognized, scope and breadth of language explored, and clarification imposed .... An essential purpose of patent examination is to fashion claims that are precise, clear, correct, and unambiguous. Only in this way can uncertainties of claim scope be removed, as much as possible, during the administrative process.

26. The claims recite "canonical quadratures", "problem interval" and "canonical integration interval". The specification (page 7, lines 12-19) recites "the solver includes tables of "canonical" quadratures for respective distances (or ranges) of the target point x from a canonical integration interval. (The interval can have one or more dimensions. For two-dimensional problems, the canonical interval is typically a straight line segment. For three-dimensional problems, it is typically a flat triangle. Higher-dimensional intervals can be used for higher-dimensional problems.) By relatively inexpensive mapping of the canonical interval to problem intervals into which a problem boundary has been divided, the solver employs the canonical intervals to integrate over the problem intervals". From this explanation the "canonical quadratures" are interpreted to be quadratures for respective distances (or ranges) of the target point x from a canonical integration interval. The "canonical integration interval" was interpreted to be an interval of straight line segments, flat triangles or higher dimensional intervals. The "problem interval" is interpreted to be the intervals into which the problem boundary is divided".

27. The claims recite “integrand” and “kernel function”. The definition of integrand (www.mathworld.com) states the definition of integrand as “the quantity being integrated, also called the integral kernel”. According to this definition, the integrand and the kernel function were both interpreted to be the quantity being integrated.

28. The claims recite “geometrical singularities”. The specification recites “at geometrical discontinuities such as corners and edges, moreover, the density function, too, can have what for practical purposes can be thought of as singularities” (page 5, lines 6-10). The term “geometrical singularities” was interpreted according to this definition.

29. The claims recite, “angle range”. The specification (page 7, lines 12-14) recites “the solver includes tables of “canonical” quadratures for respective distances (or ranges) of the target point x from a canonical integration interval”, (page 10, lines 16-17) recites “on the relative positions of the target location x and the integration interval (e.g., what the angles are on any corners)”, and (page 11, lines 11-14) recites, “a single range includes all angles likely to be encountered”. From these explanations in the specification, the “angle range” was determined to be a respective distance of the target point x from the integration interval that includes all angles likely to be encountered.

30. Claim 2 recites, “density-singularity”, however, there is no explanation of what a “density-singularity” is in the specification. This term was interpreted to be a “singularity” of the integrant at a certain point.

Claim Rejections - 35 USC § 101

31. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

32. Claims 1-6 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter. The claims are a recitation of abstract ideas since they recite mathematical algorithms, and also fail to produce a concrete, useful and tangible result. The "output signal" recited in step iv does not recite a concrete, useful or tangible result since there is no application of this result and also since the specification discusses the following with regard to the signal (page 9, lines 17-22): "ordinary wire pairs of coaxial cable would usually conduct such signals, but the signals may also be guided or unguided radio-frequency radiation, microwaves, or visible or invisible light". Also, it appears that the claimed subject matter may cover substantially every practical application of a signal having the math disclosed in steps A and B of claim 1 done.

Claim Rejections - 35 USC § 102

33. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

34. Claims 1, 2, 4-6 are rejected under 35 U.S.C. 102(e) as being anticipated by Kapur et al (US Patent 6,314,545).

35. As to Claim 1, Kapur et al teaches: an apparatus for determining field-dependent characteristics comprising: A) a storage medium containing canonical quadratures (column 2, lines 5-6; column 8, lines 55-57); and B) a computation circuit responsive to signals representing the shape of a boundary that includes geometrical singularities of different angles to: i) divide the boundary into problem intervals (column 2, lines 2-4); ii) for each of a number of target nodes, perform a numerical integration over the boundary of an integrand defined thereon by, for at least some combinations of target node and problem interval that contains a geometrical singularity that induces a singularity in the integrand, performing the integration for that target point node over that problem interval in accordance with a canonical quadrature chosen from among the canonical quadratures independently of what, within a given angle range, the value of that geometric singularity's angle is (column 2, lines 4-15; column 6, line 35-column 7, line 55); iii) determine the field-dependent characteristic at least in part by employing the results of the numerical integration thus performed (column 2, lines 17-18); and iv) generate an output signal indicative of the characteristic thus determined (column 2, lines 18-20).

36. As to Claim 2, Kapur et al teaches: A) each of the stored quadratures is associated with a respective position of a target node or a target-node region with respect to a canonical integration interval and is based on the integration, over the canonical integration interval, of the product of a kernel function and a density function,

to both of whose domains the canonical interval belongs (column 3, lines 48-61; equations 8-10, column 5, lines 56-58; column 6, lines 26-33; equation 14); B) each of a plurality of the quadratures is associated with a respective set of at least one density-singularity location on the canonical interval (equation 14, column 6, lines 56-column 7, lines 46); C) the value of the kernel function depends on the relative target-node position associated with that quadrature (column 6, lines 57-59, lines 65-66; column 7, lines 6-10), D) the density function is independent of the target node's position and exhibits a singularity only at each density-singularity position associated with that quadrature (column 6, lines 56-59; column 7, lines 8-14); and E) the quadrature performs the integration for that target point node over a problem interval by mapping the problem interval to the canonical interval and selecting therefor a said canonical interval associated with a density-singularity position at each point on the canonical interval to which a geometric singularity on that problem interval is thereby mapped (column 3, lines 33-36, lines 41-44, lines 48-61; column 6, lines 65-66; column 7, lines 8-14).

37. As to Claims 4, 5 and 6, Kapur et al teaches dividing the element to be simulated into regions, each region further divided into a plurality of quadrature nodes, pairs formed for all the quadrature nodes wherein "k" counts the number of regions in the near field, index "i" counts the number of pairs and "j" counts up to a number p of the quadrature nodes in the near field (column 2, lines 2-5, lines 21-42). From this explanation, it is concluded that the division of each region into a "plurality" of quadrature nodes in turn, determines the numbers of "ranges" or distances from r-r',

based on this number of quadrature nodes. Therefore, the teachings of the plurality of quadrature nodes, which are then used to determine "ranges" between the nodes, could encompass any number of "ranges" based on what amount is a "plurality of quadrature nodes". Since a plurality could be any number, the teachings of Kapur therefore encompass the limitations of wherein the number of angle ranges is no more than one thousand, no more than one hundred and only a single angle range.

Claim Rejections - 35 USC § 103

38. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

39. Claim 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kapur et al as applied to claim 1 above, and further in view of Yarvin et al ("An Improved Fast

Multipole Algorithm for Potential Fields on the Line", SIAM Journal on Numerical Analysis, SIAM, USA, Vol, 36,No.2, pages 629-666, 1999).

40. Kapur et al teaches a computation circuit responsive to signals representing the shape of a boundary that includes geometrical singularities of different angles to divide the boundary into problem intervals, perform a numerical integration over the boundary of an integrand defined thereon by performing the integration for that target point node over that problem interval in accordance with a canonical quadrature, and determining the field-dependent characteristic at least in part by employing the results of the numerical integration.

41. Kapur et al does not expressly teach: wherein the computation circuitry: A) applies a Fast Multipole Method (FMM) using far-field quadratures to provide an FMM result; B) identifies one or more target points for which the contribution to the FMM result from one or more intervals does not achieve a desired accuracy; C) removes from the FMM result for each such target point the contribution from each such interval based on the determined one or more points, D) performs the canonical-quadrature-integration operation for such intervals to obtain a replacement contribution, and, E) adds the second contribution to the FMM result.

42. Yarvin et al teaches a new version of the fast multipole method (FMM) for the evaluation of potential fields on the line that is roughly twice as fast as previously published algorithms (Abstract), the method of which A) applies a Fast Multipole Method (FMM) using far-field quadratures to provide an FMM result (page 630, paragraph 2, lines 1-4; page 654-660, section 5); B) identifies one or more target points for which the

contribution to the FMM result from one or more intervals does not achieve a desired accuracy (page 655-page 656, paragraph 1); C) removes from the FMM result for each such target point the contribution from each such interval based on the determined one or more points (page 657, step 1), D) performs the canonical-quadrature-integration operation for such intervals to obtain a replacement contribution (page 630, paragraph 2, lines 2-6; page 657, step 1), and, E) adds the second contribution to the FMM result (page 657, step 4).

43. Kapur et al and Yarvin et al are analogous art since they are both directed to the solving of a field characteristic through the use of quadratures.

44. It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the field dependent characteristic computation circuitry as taught by Kapur et al to further include the Fast Multipole Methods as taught in Yarvin et al since Yarvin et al teaches a new version of the fast multipole method (FMM) for the evaluation of potential fields on the line that is roughly twice as fast as previously published algorithms (Abstract).

Conclusion

45. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

46. Prabhu et al (US Patent Publication 2004/0215429) teaches system and method of a feasible point method, such as a canonical coordinates method, for solving non-linear optimization problems.

47. Ottusch et al (US Patent 6,847,925) teaches an improved method for modeling electromagnetic scattering from an arbitrarily shaped three-dimensional object to an arbitrary time-harmonic incident field.

48. Pham et al (US Patent 6,405,143) teaches a method and system for the rapid determination of a potential in a three-dimensional domain containing a source domain of source particles and a target domain of target particles is provided.

49. Stalzer (US Patent 6,175,815) teaches a method for efficiently storing quantities used by the Fast Multipole Method (FMM) to perform field calculations is disclosed.

50. Murphy et al ("Numerical Second-Kind-Integral-Equation Solutions of Electromagnetic Scattering Problems", Electronics Letters, Vol. 25, No. 10, 11th May 1989, pages 643-644) teaches a second kind integral equation solver for transverse magnetic electromagnetic scattering using quadrature formulas, handling the singularities with the singular points removed, storing quadrature weights.

51. Igarashi et al ("A Boundary Element Analysis of Transmission-Line Parameters Using Singular Elements", IEEE Transactions on Magnetics, Vol. 32, No. 3, May 1996) teaches a boundary element analysis of transmission line parameters wherein singular boundary elements are employed to adequately express the corner singularities at sharp conductor edges.

52. Mathworld (http://mathworld.wolfram.com/Integrand.html) defines integrand as ""the quantity being integrated, also called the integral kernel".

53. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mary C. Jacob whose telephone number is 571-272-6249. The examiner can normally be reached on M-F 7AM-5PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Paul Rodriguez can be reached on 571-272-3753. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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Mary C. Jacob
Examiner
AU2123

MCJ
9/19/06

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